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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of
Persson *et al.*

Serial No.: 08/384,456

Filed: February 2, 1995

For: **Mobile Assisted Handover Using CDMA**

Attorney's Docket No: 4015-5054

Patent Pending

Examiner: Nguyen T. Vo

Group Art Unit: 2685

DECLARATION OF PAUL W. DENT

I, Paul W. Dent, hereby declare as follows:

1) Prior to 14 August 1991, I conceived the invention tentatively entitled "Mobile Assisted Handover in a Cellular Phone System Using CDMA" while I was employed at Ericsson Inc. I prepared a Provisional Patent Disclosure describing the invention about 14 August 1991. A copy of that Provisional Patent Disclosure is attached as Exhibit 1.

2) After my initial conception, I, along with the other inventors, continued to develop the idea and the preferred embodiments of the invention described in the patent application. I prepared a second detailed disclosure about 24 March 1992, which included a detailed description of the preferred embodiments of the invention. A copy of the second detailed disclosure is attached as Exhibit 2. The second detailed disclosure was forwarded to an outside patent counsel working with Ericsson Inc. on or about 24 March 1992, to aid in the preparation and filing of a patent application.

3) Ericsson Inc. employs a standard review process regarding patenting an invention. The process generally includes filing of a Patent Disclosure by the Inventors, e.g., Exhibit 1, reviewing the disclosure by a patent review committee, and instructing a patent agent or attorney to prepare and file the application. On average, this process took approximately 6-9 months from initial conception to filing during the relevant time period.

4) A draft patent application covering the invention disclosed in the provisional and second Patent Disclosures was prepared by patent counsel and sent to by me for comments on or about 15 April 1992. A copy of the corresponding cover letter is attached hereto as Exhibit 3. After revisions to the application based on my comments, the application was filed with the U.S.P.T.O. on or about 17 April 1992, receiving U.S. Application Serial No. 07/870,337.

5) The invention claimed of the currently pending claims in U.S. Application Serial No. 08/384,456, of which I am a named inventor and which claims priority to U.S. Application Serial No. 07/870,337, was conceived before March 1992 and pursued with reasonable diligence until the filing of the corresponding application on or about 17 April 1992.

I hereby declare that all statements made herein of my knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

22 JULY 2003
Date

Paul W. Dent
Paul W. Dent

ERICSSON

MAHO in CDMA EXHIBIT 1 1(1)

Uppgjord – Prepared		Datum – Date	Rev	Dok nr – Doc no.
Paul W. Dent	9199907121	1991-08-14		RTP/PWD 91:052
Godk – Approved Paul W. Dent		Kontr – Checked		File

PROVISIONAL PATENT DISCLOSURE RELATING TO:
"Mobile Assisted Handover in a cellular phone system using CDMA"

This is a provisional disclosure of a new, advantageous means to control the handover of a mobile subscriber from one cell to another by using the capability of a mobile CDMA receiver to decode and measure the strengths of adjacent base transmitters' signals as well as its own.

In the present art, a mobile using FDMA cannot receive adjacent stations at the same time as its own becasue they use a different frequency.

In new TDMA systems using burst transmission, a mobile can change frequency rapidly between bursts to scan another station before reverting to its own frequency just in time for its own next burst, but this requires a fast switching frequency synthesizer.

In the new invention, a single mobile receiver operating continuously on the same frequency using CDMA is able to assess the strengths of adjacent cell transmitters sharing the same frequency by decoding their signals using their unique CDMA codes, at the same time and even using the same hardware as for decoding its own base station.

A fuller description will follow in due course.

Paul W. Dent

ERICSSON

MAHO in CDMA

Uppgjord – Prepared		Datum – Date	Rev	Dok nr – Doc no.
Paul W. Dent	9199907121	1992-03-24		RTP/PWD 92:023
Godk – Approved: Paul W. Dent	Kontr – Checked			File

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PATENT APPLICATION DISCLOSURE FOR: MOBILE ASSISTED HANDOVER USING CDMA

1. Field of invention

In mobile telephone systems, means must be provided to transfer the handling of communications with a mobile station from one base station to another, as the mobile station changes its position and so moves out of the coverage range of one station and into the coverage area of another. This process is termed "handover".

In order smoothly to effect handover, the network controlling the base stations must first of all determine, for each mobile station, whether the need for handover is imminent and secondly determine to which new base station handover should be effected. In making the latter decision it is desirable that the network controller know either how well each base station can receive the signal from a mobile in question, or how well the mobile in question can receive each base, or both. The present invention provides an improved method for the base station to acquire this information by the use of a code division multiple access (CDMA) transmission method.

2. Prior art

Prior art mobile telephone systems were based largely on Frequency Division Multiple Access, in which each mobile station transmits on a unique frequency within its current base station area. The mobile is thus unaware of signals on other frequencies from surrounding bases. In FDMA systems it would be too costly to equip mobile stations with an extra receiver that could be used to scan other base frequencies. Instead, it is established practice that base stations are equipped with a scanning receiver that looks out for the signals of approaching mobiles. The network then hands over a mobile from an area it is leaving to the base station that reports it can receive the mobile signal best.

More recent cellular telephone standards employ Time Division Multiple Access (TDMA) in which a fixed time period (e.g. 20mS) on each radio frequency is divided into a number (e.g. 3) of short timeslots (e.g. 6.6mS) that are cyclically used by different mobile stations. So a first mobile station transmits in the first timeslot in each period, a second station transmits in the second timeslot in each period and so on. Likewise the base station transmits to one mobile in the first timeslot, another mobile in the second slot and so on. By offsetting the allocation of timeslots in the two communications directions, base to mobile (the downlink) and mobile to base (the uplink), it can be arranged that a first mobile transmits in the first timeslot and receives in the second timeslot; a second mobile transmits in the second timeslot and receives in the third, while a third mobile transmits in the third timeslot and receives in the first. The advantage of this arrangement is that a mobile station does not need to transmit and receive simultaneously, facilitating sharing a single antenna.

In the above 3-timeslot example, each mobile is active for transmit or receive in two of the three timeslots and idle in the remaining timeslot. Therefore it is possible for TDMA mobiles to use this idle time to search for

signals from other base stations and measure their signal strength. By reporting these signal strength measurements to the base station using a slow speed data channel multiplexed with the traffic (i.e. voice), the network is informed about the stations each mobile can receive. The network can use this information to effect handover to the best base station, and such a system is termed "Mobile Assisted Handover" (MAHO). When the base stations scan for mobiles, the system could be termed "Base Assisted Handover" (BAHO).

Thus there are precedents for BAHO and MAHO systems in general in the established art. Systems providing MAHO also have access to the base station measurements, and so are able to effect smoother and more reliable handovers because both uplink and downlink signal strengths are taken into account, instead of just uplink strengths in the case of BAHO. However, the prior art has a number of limitations:

i) MAHO has only been possible using TDMA systems. TDMA systems involve a certain waste of capacity due to the need for guard spaces between timeslots.

ii) Fast frequency switching is needed to scan another channel in short idle periods, which is technically difficult.

iii) Available time in the idle slot combined with the above difficulty in switching frequency rapidly permit only one neighboring base frequency to be scanned per 20mS frame.

iv) FDMA mobile stations have not been able to determine the signal strengths of neighboring base stations (cells) because they were using a different frequency and FDMA mobiles cannot change frequency without loss of traffic.

The present invention uses Code Division Multiple Access to permit neigboring stations to share the same frequency channel, and thus permit the mobile to assess their signal strength without changing frequency or losing traffic.

3. Description of invention

The invention is described in the context of Subtractive CDMA Demodulation as disclosed in a separate patent application no. 07/628,359 as the preferred CDMA system, however the invention is applicable to any system in which adjacent base stations operate on the same frequency and use signals with coded features enabling them to be distinguished.

In the above mentioned application, a system is described in which coded signals are scrambled with unique scrambling codes and then transmitted on the same frequency. A plurality of signals received overlapping on a single frequency channel may include a number within the same cell as well as a number transmitted from different base stations in neighboring cells. Despite overlap in time and frequency, individual signals may be selected for

decoding by first descrambling the received signal with the appropriate scrambling code and then decoding the underlying information bearing code. Undesired interfering signals do not descramble to a form that correlates with the decoding and so are suppressed to a certain degree called the processing gain. The preferred underlying information coding is bi-orthogonal or orthogonal coding using Walsh-Hadamard functions. The suppression of the other signals is enhanced by the invention disclosed in the aforementioned patent by descrambling and decoding signals in signal strength order strongest to weakest, subtracting each signal from the whole as it is decoded. In that way, stronger signals do not substantially interfere with weaker ones and it is easier to decode weaker signals, such as might be received from more distant stations.

The general arrangement of the invention is shown in figure 1.
A CDMA decoder (10) receives a composite signal via an antenna (11), suitable amplifying, filtering and downconverting (12) and AtoD convertor (13).
The A to D convertor produces complex number outputs and can operate for example according to the logpolar principle described in patent no. (LM4793).
The CDMA decoder is programmable by means of control unit (14) with any of a number of unique descrambling codes corresponding to the overlapping signals contained in the composite received signal. These descrambling codes are presented to the decoder in descending order of signal strength of the associated signal. The decoder furnishes decoded information and signal strength measurement information back to the control unit. Signal strength information can include amplitude and phase information not only for the direct ray received from any station but also for delayed echos.
The direct ray and echo information is processed for example by filtering and summing to determine the total received energy in each signal. If signals are detected to have altered their position in signal strength sorted order, or are predicted to be about to do so, the control unit can alter the order of decoding in the next period. Decoded information contained in at least one of the decoded signals informs the control unit about the scrambling codes and/or frequencies of the cell it belongs to and/or the codes and frequencies of neigboring cells.

A preferred construction of scrambling codes is to bitwise modulo-2 add one of a number (e.g. 7) of base station ID codes to one of a number (e.g. 32) of traffic channel ID codes, as described in (E7133/027540-070). Moreover, one of the traffic channel ID codes may be reserved in each cell for use as a broadcast channel, calling channel or pilot channel as described in (E7194/027540-077). The signal using this code is always the strongest so the mobile receiver knows it shall attempt decoding of that signal before any others from the same cell.

The seven base station ID codes may be allocated to cells in a so-called 7-cell pattern such that no two adjacent cells use the same ID code. However the use of codes is repeated two cells or more away, so there can be ambiguity due to propagation anomalies as to whether a signal decoded using a particular code is from a neighbor or further away. Upon successfully decoding a broadcast channel, further information is obtained on the station

ID so resolving this ambiguity. The advantage of restricting the number of base station ID codes is so that the receiver only need attempt decoding with this limited number of codes.

Normally, a receiver only need decode and subtract signals in descending signal strength order until it decodes its own traffic channel. If the mobile station is near the edge of its cell and thus possibly about to require handover to an adjacent cell, its traffic signal will be one of the stronger signals demodulated early, as will the calling channel of an adjacent cell, so it is not necessary to decode many signals in order to acquire the desired information. If on the other hand the mobile station is near the centre of its own cell, the base station will allocate less downlink power to it and its signal will be among the weaker ones. When this situation pertains, the mobile can deduce that it is not on the edge of its current cell and thus not about to require handover. It may nevertheless attempt to demodulate the calling channel of a neighboring cell, even when the signal strength is below that of its traffic channel, by continuing decoding someway after extracting its own traffic signal.

When the mobile receiver detects from relative signal strengths that it is nearing the point where a handover might be appropriate, the base station is informed by data message from the mobile about the other base stations it can hear and their relative strengths. This process of "signal strength reporting" can also be continuous even when handover is not imminent. In order for such messages not to interrupt traffic flow, it is known to the prior art to multiplex a low bit rate data stream called the "Slow Associated Control Channel" (SACCH) with the higher bitrate traffic. It is also possible, if the need for handover becomes more urgent, to steal capacity from the traffic channel to send a high priority message. In the prior art such a priority message channel is known as a Fast Associated Control Channel (FACCH).

In the preferred implementation, the base station or fixed network contains the intelligence to decide, for each mobile, when handover is necessary and to implement it. Three forms of handover may be executed by a mobile station under control of the intelligent network controller:

- The first form, called an internal handover, is when for traffic sharing or capacity optimization reasons, the network decides to retain the mobile connected to the same base station, but to switch it to another frequency or code. If a frequency change is commanded, a slight interruption in traffic will occur while the mobile acquires synchronisation on the new frequency.

The second form of handover is the transfer of a mobile station to another base station without a frequency change. This has the potential to be a so-called glitch-free or seamless handover that involves no interruption of traffic whatsoever. In fact in the proposed system it is possible with a single mobile receiver to establish reception of the new base station before relinquishing the signal from the old base station. During this period where the mobile is receiving its intended signal from both base stations, the receiver can utilise both decoded signals to obtain diversity gain as for

example described in a separate disclosure (RTP/PWD 92:025). This system is also known as soft handover, macro-diversity, or transmit space diversity.

In order to establish communication with the second base station, the second base station is informed by the network to begin transmitting a signal for the mobile station. Since it could be disturbing for other mobile receivers already established in the new cell if a new signal suddenly appeared as one of the higher signal strengths, the new signal is preferably slowly ramped up from lowest signal strength to the desired level. This process is also used when a call is set up from scratch, known as random access, and is described in a separate application (E7217/027540-139). Until handover is complete, the old base station remains in control of the mobile's behaviour, particularly as regards controlling the mobile station's transmitter output power, as for example described in a separate application (E7101/027540-039). In implementing power control during macro-diversity or handover, the controlling base station can receive information from the other base station or stations regarding the signal strength with which they receive the signal transmitted from the mobile. Completion of handover is when control of the mobile station, including the power control function, is transferred from the old base to the new base. Macro-diversity operation can continue for a while, with the new base now as the master and the old base as the slave, until the mobile is no longer at the boundary of the two cells and the old base is informed it can terminate transmission to that mobile, releasing the code for establishing a new call. As the sudden disappearance of a signal among the strongest could also disturb ongoing traffic, the signal is preferable ramped slowly down to minimum before being turned off, as described for call termination in the aforementioned separate disclosure.

The third type of handover that might be effected is a frequency change upon changing base station. In this case, a seamless handover or macro-diversity operation cannot be achieved unless an internal handover of the first type had previously been made to the new frequency. The latter would of course be the preferable method, but may not always be possible depending on the traffic load on the various frequencies in the two cells. A separate disclosure describes frequency and code allocation algorithms that attempt to distribute these resources to mobiles according to position so as to achieve desirable laoding patterns. According to one aspect of this disclosure, an advantage is provided by means of CDMA coding permitting many calls to take place on the same frequency, so that the mean time between new call set-up or clear-down requests is reduced to a few seconds. It then becomes possible for the handover system described in this application to request reservation of capacity on any frequency for the purpose of a mobile station that is about to enter the cell, and such a request will normally be granted within a few seconds. The intelligent network controller also strives at call set-up to allocate frequencies so as to even out the loading on each frequency channel. Frequencies may be also be allocated or re-assigned by means of internal handovers according to which channel suffers least from interference from more distant stations. Using such "Adaptive Channel Allocation", the network can effectively transfer capacity on any channel from surrounding cells of light demand to a cell

with a peak demand, thus achieving averaging of capacity demand over more than one cell, which provides an increase in useable capacity without risk of momentary overload becoming unacceptable.

The implementation of handovers is effected in the mobile station by control unit (14). Further details of control unit (14) are illustrated in figure 2. Demodulation results are fed from the CDMA decoder (10) to a demultiplexor or selector (20) in control unit (14). The demultiplexor is controlled by the control processor (23) to select either only data from the current base station to which the mobile is in communication or data from both the current base and a new base to which handover is imminent. Selected data is fed to the traffic decoder (22) and the message decoder (21) which are also controlled by the control processor to accept either data only from the current (old) base or from both the old and new bases. The message decoder processes selected data so as to reduce transmission errors using both error correction decoding and diversity combination techniques and passes decoded messages to control processor (23). These messages indicate to the control processor whether the mobile station shall operate in normal mode, (i.e. decoding traffic and messages from the current base station only), or whether it shall operate in diversity mode, i.e. decoding messages and traffic based on data received from the current base and another base station, or whether it shall execute a frequency change or transmit code change.

The preferred type of handover is the so-called "soft handover" which does not involves even momentary loss of traffic. The operation of a receiver in executing soft handovers according to the invention is as follows:

A control message is transmitted from the current base station to the mobile station, indicating the CDMA code that a neighboring base will use to transmit data to the mobile station. This is processed in control unit (14) as further detailed in figure 2 causing the mobile receiver to look for and demodulate the signal from the new base station. Because it is undesirable to start new transmissions at a high power level suddenly with no warning, the new base station preferably starts transmitting to the mobile at low power and gradually increases the power level to a predetermined value. The mobile station continues for the time being to transmit using the original CDMA code, but includes data on how well it is receiving the new base station. When the old base has understood from this data that the mobile is receiving the new base station transmission sufficiently reliably, it initiates a message instructing the mobile station to regard the new base station as its current station. The old base station may then cease transmission using the original CDMA code. Because it is undesirable to suddenly terminate a high power transmission, the old base station preferably gradually reduces the power level of that CDMA code to a low level before ceasing transmission and returning that code to a pool available for establishing new communications.

The operation of the mobile transmitter during soft handover is preferably analogous to that of the base station network. Initially, the mobile continues to transmit using its original CDMA code. The current base station informs the new base station to look for and demodulate the mobile's transmission using

this code. When employing subtractive CDMA demodulation in which all signals are demodulated and subtracted in signal strength order, the new base would most likely already have been demodulating the mobile signal. The new base may exchange demodulated data with the old base, for the purposes of diversity combining the data to obtain better error correction decoding. This exchange preferably takes place by means of fibre-optic data links between the base stations, carrying multiplexed data pertaining to a plurality of mobile stations, but can also take place via, for example, coaxial landlines, trunks or dedicated microwave radio data links.

When the mobile station receives a message from its old base notifying it to regard the new base now as its current base, the mobile starts transmitting to the new base using the new base's CDMA code. Since it is undesirable to start a transmission suddenly at high power, the mobile preferably ramps up the power level of the new code from a low level to the desired level. The desired level is preferably determined according to the method disclosed in "DUPLEX POWER CONTROL (E7101/027540-039)" based on the relative signal strength the mobile station receives on its code from the new base compared to other codes from that base.

The preferred modulation method is a linear modulation method including both amplitude and phase modulation for best spectral containment. The mobile transmitter power amplifier for such modulation is thus of linear type, such as class-A, class-B or class-AB. Such an amplifier is not constrained to being able to transmit only one CDMA coded signal, but is able to transmit a plurality of superimposed signals, so long as their sum never exceeds the amplifier peak power capability. This ability may be employed by the mobile transmitter to permit initiation of transmission to the new base using a new access code before terminating transmission to the old base using the old access code. Since sudden termination of transmission using the old code is undesirable, the mobile station can gradually reduce the power level of transmission using the old CDMA code at the same time as gradually increasing the power level of transmission using the new code, in such a way that the sum of the two signals never exceeds the peak power capability of the transmitter. At the crossover point where both superimposed transmissions are of equal power, the peak signal amplitude of each must be halved for the sum never to exceed unity, and the power in each code is thus 1/4. The total power transmitted from the mobile is thus halved, but since both base stations receive transmissions using both codes, quadruple diversity is in effect provided, more than compensating for this 3dB reduction in mobile power. For this reason, it can be advantageous to prolong the period during which soft handover is in operation as long as a mobile station is near the edge of two cells. This mode of operation may also be termed macrodiversity, and is claimed as a new and advantageous means of providing mobile communications by utilizing the CDMA receiver's ability to receive two or more CDMA codes simultaneously bearing the same information, or conversely, the mobile CDMA transmitter's ability to transmit two CDMA coded signals bearing the same information.

When handover requires a frequency change because the new base cannot provide a signal for the mobile on the old frequency, it is not so feasible to achieve a "soft" handover, i.e. without interruption of traffic flow. This is

partly due to cost constraints in the mobile station which mean that only one frequency synthesizer is normally used for the transmitter and receiver. Thus with this constraint it is not possible for the transmitter and receiver to change frequency at different times. Were two synthesizers acceptable from a cost point of view, it could be decided to switch receiver frequency at a time when the downlink side of the conversation was silent, and to switch the transmit frequency at a time the uplink side of the conversation was silent. Within the constraints of a single frequency synthesizer however, it would be fortuitous if a suitable opportunity to switch frequency arose when both sides of the conversation were silent. Nevertheless, it can cause least perceived disruption in a conversation if the frequency is switched just at the time one side or other of the conversation becomes silent, as there can be a delay before the other party commences talking in which the frequency change can be performed with least perceived disruption. If such an opportunity does not arise before handover becomes urgent however, a handover is forced by the current base station transmitting a channel change command to the mobile in place of speech traffic, the channel change command being a data message containing details of the frequency, new base station ID and new CDMA traffic code that the mobile shall use. The mobile terminates transmission on the old frequency smoothly, changes frequency, then starts transmission on the new frequency smoothly. Meanwhile, the new base is informed by the old base to expect the mobile signal. In the event that both bases are able to receive on both the old and new frequencies, space diversity reception as previously described can be provided on both the old and new frequencies to improve reception quality while the mobile is in the handover region. There is no point in the old and new bases transmitting to the mobile simultaneously on different frequencies however, as the mobile, in contrast to the base, is only equipped to receive on one frequency at a time. Ramping up the power level of the transmission from the new base using the new CDMA code can nevetheless be done before or in parallel with ramping down the power level of the old transmission so that both will in fact overlap for a short while and the interruption in traffic as the mobile changes frequency is not unnecessarily prolongued by having to wait for the new base transmission to appear.

A base station network for implementing handover as described is illustrated in figure 3. A first base station (32) having an antenna system (30) and a CDMA transmitter/receiver system (31) is connected by communications links, preferably but not necessarily limited to fibre-optic lines, to one or more base station controllers (36). A second base station (35) to which a mobile station in communication with the first base station shall now communicate is also connected by similar links to the base station controller.
The base station controller may simply switch data through from one base to another under command from a switching center, the diversity combination being implemented in the first or second base station or both. Alternatively the base station controller itself may perform the diversity combination or selection of data from two or more base stations. The choice of location of these functions is not considered material to the invention and is more a question of installation convenience. Thus error correction decoding subsequent to diversity combination may reside at base stations (32) and (35)

or at base station controller (36) or indeed at the switching centre. Likewise any digital speech decoding subsequent to error correction decoding may reside in any of these locations.

These variations in implementation are at the discretion of anyone skilled in the art while still falling within the scope of the invention as set forth in the following claims.

4. CLAIMS

I claim:

1. In a cellular mobile radio communications system including at least one mobile station and at least two base stations a method of transferring communication with said mobile station from a first to a second of said base stations involving:

   -transmitting a signal on a first frequency from said first base station to said mobile station using a waveform encoded with a first code,

   -sending an indication from said first base station via a fixed network to said second base station,

   -upon receipt of said indication, transmitting a signal on said first frequency from said second base station to said mobile station using a waveform encoded with a second code,

   -receiving at said mobile station said signals transmitted on said first frequency from said first and second base stations and decoding them using said first and second codes to produce a first and second demodulated signal.

2. In a cellular mobile radio communications system including at least one mobile station and at least two base stations a method of transferring communication with said mobile station from a first to a second of said base stations involving:

   -transmitting a control signal on a first frequency from said first base station to said mobile station using a waveform encoded with a first code to inform said mobile station of a second frequency and code,

   -sending an indication from said first base station via a fixed network to said second base station,

   -upon receipt of said indication, transmitting a signal on a second frequency from said second base station to said mobile station using a waveform encoded with a second code,

-upon receipt by said mobile of said control signal, receiving said signal on said second frequency and decoding it with said second code to produce a demodulated signal.

3. A method according to claims 1 or 2 in which said first code includes a first base station code combined with a first access code and said second code includes a second base station code combined with a second access code.

4. The method according to claim 1 further including an error correction decoder to process said demodulated signals to produce an error correction decoded signal.

5. The method according to claim 4 in which said error correction decoder performs diversity selection of symbols from said first and second demodulated signals.

6. The method according to claim 4 in which said error correction decoder peroms diversity combination of said first and second demodulated signals.

7. In a cellular mobile radio communications system including at least one mobile station and at least two base stations a method of transferring communication with said mobile station from a first to a second of said base stations involving:

-decoding at said mobile station signals received simultaneously from said at least two base stations on a first frequency and quantifying their relative signal strengths,

-transmitting a signal from said mobile station indicating said relative signal strengths,

-receiving at one of said base stations said signal indicative of signal strengths and sending it to a network controller,

-processing said indicated signal strengths in said network controller and deciding which of said at least two base stations shall maintain communication with said mobile station.

8. A method according to claim 7 in which said network controller controls said decided base station and causes it to initiate a transmission to said mobile station using an available access code.

9. A method according to claim 7 in which said access code is composed of a base station code combined with a traffic channel code.

10. In a cellular mobile radio communications system including at least one mobile station and at least two base stations a method of transferring communication with said mobile station from a first to a second of said base stations involving:

-transmitting traffic on a first frequency from said first base station to said mobile station using a waveform encoded with a first code,

-transmitting a control message on said first frequency from said first base station to said mobile station using a waveform encoded with a second code,

-sending an indication from said first base station via a fixed network to said second base station,

-upon receipt of said indication, transmitting a signal on said first frequency from said second base station to said mobile station using a waveform encoded with a third code,

-receiving at said mobile station said signals transmitted on said first frequency from said first and second base stations and decoding them using said first, second and third codes to obtain a first demodulated traffic signal, a decoded control message and a second demodulated traffic signal.

11. A method according to claim 10 in which said first code includes combination of a first base station code with a first traffic channel access code and said second code includes combination of said first base station code with a control channel code.

12. A method according to claim 11 in which said third code includes combination of a second base station code with a second traffic channel code.

13. A method according to claim 11 in which said third code includes combination of a second base station code and a control channel code.

14. A cellular mobile radio telephone using Code Division Multiple Access to facilitate handover between a first and second base station including

-antenna, filtering, amplifying and downconverting means to produce an analog signal representative of signals received from said first and second base station on the same frequency,

-analog to digital conversion means to convert said analog signal to a sequence of numerical values,

-CDMA processing means to process and decode said numerical values using a first and second code to obtain demodulated data signals received said first and second base station transmitters and measurements of their relative signal strengths or qualities,

-encoding means to encode said signal strength or qualities ir to a data message,

-CDMA transmitting means to transmit said data message.

15. A mobile station according to claim 14 in which said first code includes combination of a first base station code with a first access code and said second code includes combination of a second base station code with a second access code.

16. A method or apparatus according to any of the above claims in which said codes include orthogonal or bi-orthogonal coding using Walsh-Hadamard codes.

+ many more claims to be extracted from the text

OIPE JC117 JUL 2 8 2003 PATENT & TRADEMARK

EXHIBIT 3

BURNS, DOANE, SWECKER & MATHIS

ATTORNEYS AT LAW
GEORGE MASON BUILDING
WASHINGTON & PRINCE STREETS
POST OFFICE BOX 1404
ALEXANDRIA, VIRGINIA 22313-1404

FAX (703) 836-2021
FAX (703) 836-3503
FAX (703) 836-7356

TELEX: ITT 440 580 BDSM ALE

TELEPHONE (703) 836-6620

SAN FRANCISCO, CA AREA OFFICE
3000 SAND HILL ROAD
BUILDING 4 - SUITE 160
MENLO PARK, CALIFORNIA 94025
TELEPHONE (415) 854-7400

April 15, 1992

Mr. Paul W. Dent
Ericsson GE Communications Inc.
P.O. Box 13969
1 Research Triangle Drive
Research Triangle Park, NC 27709

VIA FEDERAL EXPRESS

RECEIVED
JUL 3 0 2003
Technology Center 2600

Re: New U.S. Patent Application entitled "Mobile Assisted Handover Using CDMA
Our Reference: 027500-386

Dear Paul:

Enclosed please find a copy of a draft application including a preliminary set of claims of the above-identified disclosure for your review. As you are probably aware, we will be filing this application on **Friday, April 17, 1992** prior to Ericsson's submission of written answers concerning CDMA systems.

Accordingly, we look forward to receiving your technical comments regarding the application by Friday. In particular, please note the questions incorporated into the draft.

If you have any questions concerning the draft application, please feel free to contact Steve du Bois at (703)-838-7575 or me.

Very truly yours,

Steven M. du Bois

for Ronald L. Grudziecki

RLG/SMD/lal
Enclosure

cc: Mr. Krister Raith
Mr. Tage Lövgren